DEPARTMENT OF COMMERCE

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1 Water Penetration of Concrete Tanks

Concrete tanks of 1:2:4 proportions have been made and tested to determine the effect of varying percentages of mixing water on the permeability of concrete. Thus far, the results indicate that the wetter mixtures permit of more penetration than do those of mushy consistency.

2 Oil Storage in Concrete Tanks

Most of the observations on concrete tanks, within which oil has been stored under pressure, have been completed. Only four tanks, which contain some of the heavier oils, are still under test. These tests will be continued indefinitely and observations made from time to time to determine what effect the length of time of exposure has on the rate of loss. A new series of tests will be shortly commenced on 1:1-1/2:3 concrete tanks for data on this mixture. This series will be used also as a basis of comparison for the various oil-proofing methods.

3 "Plasticity" and "Workability" of Concrete

Tests have been continued on methods of measuring the workability quality of concrete as distinguished from flowability. Tests have been made in which the weight of a tamped cylinder (100% workmanship) is compared with a cylinder filled by dribbling or allowing the concrete to flow in the measure with zero percent, work. The dribble specimens, having nearly the weight of the tamped ones, have been found to be the more workable mixture. In the case of rich concretes and those with lime, the differences between the tamped and dribble weights were found to be less than for lean concretes and those without lime.

A new method of measuring plasticity, in which a circular pat of concrete is placed on a revolving disk and rotated at different speeds, has been tried. Preliminary results are promising, but additional work will be necessary before a statement can be made as to the value of this method.

4 Times of Set of Concrete and of Cement Measured by a a New Method

Measurements of the time of set of concrete have been made by a new method consisting of molding several disks of concrete and placing them in a damp closet and obtaining their flowability at given intervals until about three or four hours after mixing. Indications are that the flowability decreases with time and the point at which the concrete ceases to flow and becomes crumbly can be considered its initial set. Tests have been made on neat cement with similar results, except that the point of no-flow was reached in a somewhat longer time.

5 Durability of Cement Drain Tile in Alkali Soil

After an interruption of two years due to the pressure of war work, the field inspection and testing in connection with the investigation on the durability of cement drain tile in alkali soils has again been taken up. In Minnesota, pieces of tile which have been in the ground since the last inspection have been removed for test and the concrete found to be uninjured either by alkali or acids, but a number of both the best and poorest tile were found to be cracked. It is thought that sometime during the cold weather water had backed up and stood in the pipe freezing and bursting it. A complete survey of all the more important reclamation projects in the West is to be made in the near future and based on this work the committee in charge of the investigation will endeavor to make definite recommendations relative to the manufacture and use of cement tile in alkali soils. The results of the work already accomplished are embodied in the Bureau's Technologic paper T95 "Durability of Cement Drain Tile in Alkali Soil".

6 Comparative Concrete Tests Using a Fine and Normal Cement

Comparative tests have been made on two cements submitted by a certain manufacturer. The first cement was of normal fineness, while the other was a specially fine cement. Results of two-day tests indicate that the concrete made of the fine cement is about 10% stronger in the three mixes tried than the concrete made of normal cement.

7 Investigation of Inductance Coils used in Radio Communication

Although the inductance coil is one of the principal elements of all radio communication systems and progress in the development of such systems depends largely on improvement in the design of these coils, very little comprehensive information has been available concerning their constants and behavior. It has been common practice to use such coils as have been found to serve the purpose required for a given apparatus and thus a great variety of them are at present in use. A careful investigation has been under way for several months to determine the merits of different types of coils, and the electrical properties of a number of them have been measured, including inductance, resistance, and capacity over a wide range of wave lengths and other conditions. Many interesting points have been discovered in the behavior of these coils, particularly when radio detectors of various types are connected to them. As a result of the investigation, formulas and data have been obtained by which the behavior of a particular kind of coil can be determined and its value for certain uses predicted.

8 System of Radio Fog Signalling

In cooperation with the Bureau of Lighthouses, experiments are being carried on to establish a radio fog signalling system. Such a system, when perfected, will give to the

navigator a reliable signal under any conditions of fog and make him independent of the lighthouse lamp. The principal object to be sought is the sending out of a radio signal automatically from a lighthouse and the reception of this signal upon a ship by a very simple radio direction finder. If a number of important lighthouses on the Atlantic coast are equipped with this system, the safety of navigation will be greatly advanced. In connection with these experiments, radio transmitting apparatus is being placed at three lighthouses in Chesapeake Bay and the radio receiving apparatus and direction finder installed on a lighthouse tender. Three lighthouses are used, so as to give comparative information on different types of modern transmitting equipment, and to determine which is the best suited for this work. The apparatus is of special types developed by the Bureau as a result of some of its researches on radio problems during the war.

9 Revision of National Electrical Safety Code

The revision of the National Electrical Safety Code, preparatory to the publication of a new edition, is nearly completed. During the month, the proposed changes in Part 1, comprising the rules for Electrical Generating Stations, have been circulated in the industry for criticism and suggestions. Early in September, the proposed changes in the section covering Protective Grounding will be similarly distributed. Agreement has been reached with the interests concerned in the crossing of telephone and telegraph wires over railroad tracks, for the radical revision of the rules governing such construction. The rules governing the construction of electric power lines are now under consideration and soon a revised draft of the rules governing all outdoor construction will be submitted for general criticism. This has been somewhat delayed by a survey of such construction covering the entire country which has been carried out in cooperation with a committee of the National Electric Light Association in order to determine present practice. It is anticipated that this revision of the present rules in the National Electrical Safety Code will result in a set of requirements which will be generally satisfactory to all concerned, and consequently will meet with ready acceptance and be placed in legal force by the local authorities in a large number of states.

10 Use of Cadmium Electrode in Storage Battery Testing

A paper on this subject is now in press and describes experiments made to develop a reliable method of measuring separately the capacity of the positive and negative plates of a storage battery under test. While the cadmium electrode has been used for a number of years past, it appears that

very few precautions have been taken to avoid the errors to which it is subject, the chief of which is due to the polarization of the electrode. If the cadmium electrode is used to measure the potential of the positive plate only, the result may be in error by 1/10 and 2/10 of a volt. This is what is commonly done, but in the paper here considered, it is shown that the error in measuring the negative plate is entirely negligible as compared with that in measuring the positive plate. The cause of the polarization is the fact that the low scale voltmeters commonly used have a resistance of only about 300 ohms. The current which flows through this circuit, due to the difference in potential between the positive plate and the cadmium electrode, is sufficient to polarize it.

11 The Potential of the Manganese Dioxide Electrode used in Dry Cells with Reference to the Hydrogen Ion Concentration

A paper on this subject has been prepared describing a series of experiments made to determine the effect of changes in the hydrogen ion concentration on the potential of dry cell electrodes prepared from various manganese ores. It is shown that the effect of adding acid to the cell is to increase the voltage for a short time only. This practice has been resorted to by some unscrupulous manufacturers, but it is shown that the effect is deleterious to the cell. The results of the paper also explain many of the accidental variations of voltage of dry cells made from the same material.

12 Resistivity of Powdered Manganese Dioxide and Carbon and of Mixtures of the two

A series of experiments on the electrical resistance of materials used for the depolarizing mixture in dry cells is described in a recent paper. The resistivity of the manganese dioxide was found to vary over a wide range, depending upon the fineness and the pressure applied to it. This, however, was not the case with carbon. In dry cells these two substances are mixed in various proportions and the results of this investigation show that a marked change in the resistivity takes place when the mixtures contain less than 30% of the carbon, therefore, a satisfactory dry cell should contain as much as 30% carbon in the mixture.

13 Determination of Nitrates and Nitrites in Storage Battery Acid

A large number of experiments have been made to find the most satisfactory method of testing for these impurities in the electrolyte used for storage batteries. Many of the methods are not applicable to the strong acid used in storage batteries but a few have been chosen, which appear to be best adapted to such testing, and these methods appear to be capable of revealing very minute amounts of these impurities.

14 Production of the Rare Sugar d-Mannite for the War Department

The so-called rare sugars are used to a considerable extent by the Medical Corps of the army and by the profession in general. One of the principal uses to which they are put is the differentiation of bacteria, for which purpose they are invaluable. For some time, the Bureau has had presented to it for test a number of these rare sugars. Owing to the large demand for one of these sugars, known as d-Mannite, the Bureau has undertaken, at the request of the War Department, the production of a considerable quantity of this substance. The Bureau's investigation has finally developed a method whereby pure white crystals of d-Mannite can be produced by two crystallizations from the crude manna. It has thus become possible to produce relatively large quantities of this valuable substance at a reasonable cost. The equipment for the work is partially installed and the process of manufacture well under way, and already over one hundred bottles of d-Mannite have been produced.

15 Combined Laboratory and Service Tests of Range Finders

In cases where instruments are subject to severe field service, the question has always arisen as to the real value of tests under laboratory conditions. This applies with particular force to such instruments as range finders. In cooperation with the Ordnance Department of the army, a combined laboratory and field test of several different types of range finders, which the army has bought within the past few years, has been undertaken. These instruments will first be put through the standard laboratory tests which include those for light transmission, equality of magnification, resolution, etc., after which they will be given a service test at Fort Sill by the Ordnance Department to determine their relative accuracy and permanence of adjustment under service conditions. It is expected that this combined test will furnish valuable information upon the practical effectiveness of the laboratory test as well as making an accurate comparison between the performance of various designs under working conditions.

16 Photographic Lenses

During the past month, 21 photographic lenses were tested for the Photographic Branch of the Air Service, using the news lens testing chart developed by the Bureau, which was mentioned in last month's report. The chart was found to be entirely satisfactory and a great help in grading lenses according to their quality. In addition to the 21 regular tests of lenses mentioned above, 3 were tested to determine the amount of distortion they produced.

17 Investigation of Copper Crusher Plugs

The investigation of copper crusher cylinders, used in determining the quality of powder employed in small arms and cannon, has been continued. Experiments have been made on cylinders aged for two weeks at a temperature of 100°C, and alternately at 100°C and 0°, respectively. Apparently the effects of such aging treatment on the compressive strength are the same as obtained by aging for the same time at room temperature.

18 Deep Etching of Steel

As mentioned in the last report, an important investigation now being carried on is that which deals with the deep etching of steels, i.e., prolonged immersion in concentrated acids. The work during the month on this subject indicates that the deep etching of highly strained steel causes the development of cracks which has previously been shown to be the case with internally stressed bronzes. Such cracks in steels are not to be confused with those observed in steel rails showing "transverse fissures". The cracks in such rails pre-exist and are not developed by etching treatment.

19 Zirconium Steel

A report is in preparation showing the heat treatment, impact tests, and tensile strengths of a large number of plates that have been submitted to the Navy Department for ballistic tests. Chemical analyses made by the Bureau of Mines are also to be given in this report. For this investigation, during the month, 33 plates were normalized, 45 hardened, and 33 tempered; 12 tensile specimens were normalized, 2 hardened, and 2 tempered; 16 impact specimens were normalized, 12 hardened, and 2 tempered.

Thirty-six samples of zirconium steel were analyzed at the Bureau, for zirconium, titanium, and aluminum. The Bureau's method for determining titanium in such steels was thoroughly tested and found to be accurate within experimental errors.

It has been found that steels which contain boron may be successfully rolled if the temperature of rolling is kept below 1000°C. Such a steel when rolled at 1010°C broke under the rolls.

20 Elastic Properties of Steel Springs

Steel springs are used for such a great variety of purposes that the determination of the elastic properties of metals used in their manufacture is of great importance. Apparatus adapted for studying the elastic properties of metals to be made into springs has been built and tested. Various metals, such as straight carbon, nickel-chromium, and nickel-vanadium steels, are being compared. At present, the order of merit of these various alloys is about as given above.

21 Sulphur Specifications for Steel

The sulphur content of steel for various purposes has always been included in the specifications for steels. An investigation is to be carried out by the Bureau and others for the Railroad Administration, to determine the effects, from the point of view of laboratory and service tests, on the physical properties of steel of the addition of sulphur in varying amounts to the molten steel in the ladle. It is expected that this investigation will lead to a revision of the steel specifications so far as the sulphur content is concerned which are used by the Railroad Administration.

22 Preliminary Results of Tests of Structural Steel at High Temperatures

The strength of steel at high temperatures has an important bearing upon the stability of a structure which may be subjected to fire. Experience has shown that unprotected steel columns fail when exposed only 10 or 15 minutes to temperatures such as are commonly met with in fires. By the use of suitable protective coverings, such as concrete, brick, hollow tile, metal lath, plaster, etc., the heat may be kept away from the steel column to such an extent that it will not fail even after several hours' exposure to intense heat. In order to properly design such protective coverings, it is necessary to know the strength of steel at various temperatures, as well as the temperature which the steel is likely to attain in a conflagration. Some preliminary tests have been made on the compression strength of specimens of structural steel when heated in an electric furnace to temperatures corresponding to dull red heat (about 1100°F) and loaded up to 20,000 lb. per sq. in. It was found that structural steel, when loaded to 10,000 lb. per sq. in. fails at about 1075°F, and a load of 20,000 lb. per sq. in. failure occurred at about 925°F, but the limit of utility as a structural member is reached at temperatures of about 130° below those given above.

23 Information Concerning Optical and Radiation Pyrometry

In many industrial operations, high temperatures are measured by determining the intensity of the light or heat emitted by the heated bodies. Instruments used for such purposes are known as optical or radiation pyrometers. Their development during the past ten years has been extremely rapid, and a summary of the present state of the art should prove useful to those employing such instruments. Such a summary has been prepared giving concise information on the use of pyrometers in the industries and has been published in the bulletin of the American Institute of Mining and Metallurgical Engineers.

24 Investigation of High Altitude Performance of Aircraft Engines

Continuing the work mentioned in the report of last month, general analyses of the problems involved in the operation of engines at altitudes have been continued. A 300 H.P. Hispano-Suiza engine has been installed in the laboratory and tests made under conditions such as are met with on the ground and at 25,000 feet altitude at various speeds and under different openings of the throttle. This work has been carried on in cooperation with the Air Service at McCook Field, Dayton, Ohio.

25 Airplane Radiator Investigation

Preliminary work has been done on measuring the temperature gradients through the air tubes of radiators by the use of a movable thermocouple. The pressure drop through a section of exhaust pipe for dirigibles furnished by the Navy Department has also been determined.

26 Detection of Turbulence Within the Cylinder of an Internal Combustion Engine

Previous reports have mentioned the investigations being carried on to determine conditions existing within the cylinder of internal combustion engines. This work has been continued during the past month and an attempt has been made to detect turbulence within the cylinder, and to determine its effect upon the velocity of flame propagation. The results so far obtained indicate that in the vertical plane, including the spark plugs, turbulence is without effect on the motion of the flame and that with advanced spark, the velocity of propagation increases.

27 Investigation of the Power Plants of German Motor Trucks

In cooperation with the Motor Transport Corps, examinations have been made of a number of German motor trucks delivered under the terms of the armistice. Two engines have been dismantled and the dimensions and weights of the essential parts determined and photographs taken of the various portions of the engine. One of these engines has been re-assembled and is being prepared for dynamometer test. Examination is also being made of several magnetos as well as Zenith and Palas carbureters belonging to these trucks.

28 Development Work in Connection with Aeronautic Instruments

The National Advisory Committee for Aeronautics recently submitted designs for a rate-of-climb indicator for use in performance tests of aircraft. These instruments have now been completed in the glassblowing shop of the Bureau and some development work has been done, because the original design was not such as to permit of a uniform scale. Work has also been continued on the Bureau's own type of rate-of-climb indicator based on the action of thin metallic diaphragms and thus dispensing with the use of a liquid manometer. In this connection, apparatus has been developed for producing in the laboratory by means of a series of standardized capillary tubes any desired rate of climb, so-called, inside the test container and maintaining it constant for a considerable length of time. It is believed that this is the first time

that such apparatus has ever been regularly available and its use will aid greatly in the successful development of such instruments. To facilitate the testing of altimeters and the preparation of standard testing outfits for use by other government departments at testing stations, an improvement has been made in the Bureau's air-tight aluminum altimeter containers, which consists of a special process for vulcanizing the rubber gaskets directly on the aluminum metal. This process was worked out by the Bureau's rubber section.

The process of constructing the so-called D-springs, a special form of bent sheet metal spring for altimeters, has been taken up in the Bureau's instrument development shop. A special grade of steel has been prepared for this purpose.

The diaphragm investigations previously referred to have been continued and extended to include the actual construction of vacuum boxes for aneroids, so as to determine how much of the fatigue effect can be attributed to the method of soldering the two diaphragms together to form a box. The testing equipment for investigating separate diaphragms has also been further improved during the month by the construction of a set of ring mounts in which the diaphragms can be kept permanently clamped and tested when desired. This eliminates errors due to looseness of support when the micrometric measurements are made, an error which was particularly troublesome when the sample diaphragms had become warped through heat treatment. Much more consistent results are now secured, and the testing of such samples has been expedited.

29 Airplane Wing Coverings

Research on this important subject is being continued. Tests, which include determinations of the elastic modulus, tensile strength, and tongue and rip tear resistance of thin sheet metals and fine wire mesh, have been completed, and a preliminary report with a full discussion of the problem is being put into finished shape. There have been ordered for test sheet duralumin .015" thick; sheet nickel .006" to .003" thick; sheet steel .001" to .003" thick, and wire mesh made of high strength steel wire. The results of the investigation so far have eliminated as unsuitable certain materials and constructions and indicste some others as promising. These are fully discussed in the report. Some attention has also been paid to the possible use of transparent material for at least a portion of the airplane wing, in order to give the aviator an enlarged field of view. Among such materials the so-called "Fireproof Moving Picture Film" (cellulose acetate) has been examined.

30 Aeronautic Instruments Circular No. 11

Aeronautic Instruments Circular No. 11, which was prepared for confidential use during the war, has been completely revised and enlarged. This circular covers the subject of testing methods for airplane tachometers and contains 23 illustrations, among which may be mentioned a photograph of the standard testing outfit for general tests, the soundproof chamber for endurance runs, the special apparatus for testing tachometers of the air viscosity type under a partial vacuum corresponding to high altitudes, and a temperature chamber especially adapted for tachometers. Owing to the limitations of the staff which are detailed to the work of getting out this circular, it has not been possible to fully meet the demands for it, due to the large number of photographs and other material which it contains.

31 Investigation of Barographs used in Recent World's Record Altitude Flight

At the request of the Aero Club of America and the Curtiss Engineering Corporation, an experimental investigation has been made of the barographs used by Mr. Rohlf in his recent world's record altitude flight. In a flight of this kind, the instrumental corrections due to the effect of temperature are very large and until more care is taken in the selection of barographs for this purpose, authoritative results cannot be easily secured.

32 Slippage of Cemented Rubber Seams in Balloons

A series of tests has been completed on the slippage of cemented seams under conditions existing in the gas bag of a balloon. These conditions include considerable stress and quite a high temperature when the balloon is exposed to bright sunlight. Results of these tests show that the entire stress must be quickly transferred to the sewed portion of the seam, as the cement contributes little, if anything, to the ultimate strength of the seam, aiding only in its gas tightness.

33 Continuous Helium Recorder

An apparatus, which continuously records the percentage of helium in a gas mixture, has been designed, constructed, and installed at Petrolia, Texas, and has now been in use more than a month. Analyses of the gas are frequently required, in order to control the operation of the plant. Such analyses, when made by the older methods, require so long a time that the operating condition they represent may have changed entirely before the results of the analysis are available. The recorder, however, gives a continuous record which is always up to date.

34 Reclamation of Paper Stock from Rubbish

A representative of the Bureau recently witnessed a test of a new method of reclaiming paper stock from the rubbish collected from dwelling houses which is made up principally of paper, rags, iron, glass, and dirt. By using this method, 30% of paper stock was recovered from 70 bales of this rubbish, while by the usual methods of sorting a maximum of 10% paper stock is saved. In other words, the new method is superior by from 200 to 300% over the usual practice.

35 Routine Testing of Timepieces

The number of ship watches tested during the month was considerably above the highest previous record. The number of watches and clocks of all sorts accepted during the month was 1,268. The demands of the Emergency Fleet Corporation for ship watches and for comparing watches were so great that considerable doubt has existed on several occasions as to whether they could be met. This situation was aggravated by the percentage of ship watches which failed to pass the test, this percentage increasing from the usual figure of approximately 20% to about 50%.

36 Precision Weights

Nearly three times as many standard weights were received for testing during August as in previous months. This increase appears to be due, first, to the increased knowledge concerning the Bureau's work along these lines; and, second, to the return of manufacturing business to normal conditions, since the cessation of hostilities. Owing to the fact that it has been difficult to retain trained assistants for this work, a large number of untested weights are on hand. Every effort is being made, however, to increase the rate of such testing, in order that as little delay as possible may be experienced by those submitting these weights.

37 Calibration of Precision Gages

Three hundred and sixty-two thread, profile, precision, and plain gages were tested during the month. In addition to the completion of the test of an 80" measuring machine for the Washington Navy Yard, some of the calibration of the Bureau's 80" machine was undertaken. In performing this work, the value of the constant temperature room was clearly shown.

38 Test of Anemometer Type of Air Meter

An air meter of the anemometer type was tested for the Department of Terrestrial Magnetism of the Carnegie Institution. This meter has been used for determining the electrical conductivity of the air and was installed on the yacht "Carnegie". The result of this test showed that a previous one made by outside parties gave results considerably in error.

39 A New Publication of the Laws Covering Weights and Measures

Considerable work has been done in compiling the weights and measures laws of the various states with a view to issuing a new edition of Miscellaneous Publication No. 20, "The State and National Laws Concerning the Weights and Measures of the United States". The last edition of this work was issued in 1912. On account of the great amount of weights and measures legislation, which has been added to the statutes in a large number of states since that time, and because of the changes in existing legislation, the last edition has now become obsolete. During the war, however, it was not deemed advisable to attempt the issuance of a new edition, but it is hoped now to push forward the preparation of an up-to-date compilation.

40 Physical Tests of Milk Bottles

Owing to the severe service which milk bottles are called upon to withstand, it is essential that they be constructed of glass possessing unusual strength. A comparative impact test has recently been conducted on such bottles; 47 bottles were used, half of them being made of standard type, and the other half of a new type of glass. It was desired that both old and new glass be subjected to the same test, in order to discover which was the stronger. The results would seem to indicate about the same strength for the new as for the old glass.

41 Investigation of the Action of Muriatic Acid on Manila Rope

At the instigation of the National Safety Council, an investigation has been undertaken to determine the action of muriatic acid on manila rope. The effect of this acid or its fumes on rope of this kind is a great menace, as the acid weakens the rope seriously without any superficial trace of the action being noticeable to the eye. When rope is exposed to this acid, as, for instance, when it is used in blocks and falls of swinging staging when washing down brickwork, etc., many serious accidents have resulted, some of which have been fatal, owing to the fact that the rope has been weakened through contact with this acid or its fumes. The only practical remedy suggested is that of treatment of manila rope before using with some acid-resisting compound. An attempt will be made in this investigation to determine by testing, the actual effect of the acid, and ascertain if the deterioration can be remedied by impregnating the rope with a certain compound which the National Safety Council advances as having been effective in protecting machinery and equipment from acid corrosion.

Respectfully,

S. W. STRATTON

Director
HGB